

# PATENT ABSTRACTS OF JAPAN

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(71)Applicant : NIPPON DENYO KK

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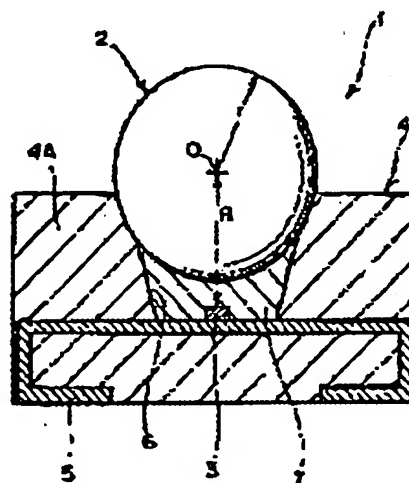
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SHONO HIROO

## (54) LIGHT EMITTING DIODE UNIT

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain an LED unit suitable for mounting on a board in which the distance between a lens and an LED can be set freely depending on the application and the output light from the LED can be directed collectively in one direction.

**SOLUTION:** The light emitting diode unit comprises an LED 3, a lead frame 5 for feeding an applying voltage thereto, a translucent region 7 for introducing the output light from LED 3 and surrounded by a reflective wall 6 in order to introduce a part thereof in substantially same direction, a condenser lens 2 secured directly above the LED 3 in the translucent region 7, and a support 4A for the condenser lens 2.



## LEGAL STATUS

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**CLAIMS**

**[Claim(s)]**

[Claim 1] The light emitting diode held at the leadframe, and the unit base holding said leadframe. The annular lens base material with which an end side is joined to said unit base, and the reflective wall which is attached so that said light emitting diode may be surrounded in the center section of this lens base material, and reflects the outgoing radiation light from said light emitting diode. The light emitting diode unit characterized by having the condenser lens arranged at the other end side of said lens base material so that the light transmission field surrounded by this reflective wall and said unit base may be taken up, and a lens fixed means to fix this condenser lens to said lens base material.

[Claim 2] The light emitting diode unit according to claim 1 characterized by really fabricating said leadframe, said unit base, and said lens base material.

[Claim 3] Said lens fixed means is a light emitting diode unit according to claim 1 or 2 characterized by being translucency adhesion resin with which said light transmission field is filled up.

[Claim 4] Said lens base material is a light emitting diode unit given in claim 1 characterized by being formed by the opaque white resin which made the mirror plane to the wall surface of said reflective wall thru/or one term of 3.

[Claim 5] Said condenser lens is a light emitting diode unit given in claim 1 characterized by being a ball lens thru/or one term of 4.

[Claim 6] Said condenser lens is a light emitting diode unit given in claim 1 characterized by being a plano-convex lens thru/or one term of 4.

[Claim 7] Said reflective wall is a light emitting diode unit given in claim 1 characterized by being a major diameter like said condenser lens side thru/or one term of 6.

[Claim 8] A light emitting diode unit given in claim 1 characterized by equipping further the other end side of said lens base material with the positioning means of said condenser lens thru/or one term of 7.

[Claim 9] The light emitting diode unit according to claim 6 characterized by forming a flange in the periphery of said plano-convex lens.

[Claim 10] A light emitting diode unit given in claim 6 characterized by enabling setting out of the outgoing radiation light from said plano-convex lens free [ collection and distribution ] with the combination of the convex configuration of said plano-convex lens and a refractive index, and the distance from said light emitting diode to the flat side of said plano-convex lens and the refractive index of said light transmission field thru/or one term of 9.

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**DETAILED DESCRIPTION**

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**[Detailed Description of the Invention]**

**[0001]**

**[Field of the Invention]** This invention relates to the light emitting diode unit of the suitable high brightness for the surface mounting to a substrate side etc. especially about a light emitting diode unit.

**[0002]**

**[Description of the Prior Art]** Generally, the light emitting diode (LED) used widely is formed with the semi-conductor until now so that it may be well-known, the light of the wavelength decided by minute size with an ingredient is emitted, and it has the property of operating by the low battery. Then, the outside used as a photo coupler combining photo detectors, such as a photo transistor, various electronic equipment is also used as a display component, and this LED is being used also as a light emitting device of optic fiber communication.

**[0003]**

**[Problem(s) to be Solved by the Invention]** In by the way, the case of the LED unit of the substrate mounting mold (surface mounting type) to this For example, after joining LED electrically on [ such as a thing made from Hewlett Packard (United States), ] the leadframe formed in the package mold so that it might be easy to mount, Since a perimeter is really fabricated with a transparence epoxy resin etc. and he is trying to create a unit, Although it is a non-spread mold, since it is easy to carry out the diffused light of the light from LED to the perimeter section and luminous intensity thru/or brightness are not raised, when it is influenced of other light, such as daylight, and it is hard to view when used as a display device and it is included in an optical detector element, there is also fear of incorrect detection.

**[0004]** This invention has the 1st object in offering the suitable light emitting diode unit for the substrate mounting mold which can be set up free according to an application in the distance between a condenser lens and LED paying attention to the above-mentioned conventional problem.

**[0005]** Furthermore, the 2nd object of this invention has manufacture in offering the easy and suitable light emitting diode unit for the substrate mounting mold which can moreover collect light efficiently and can be made to output to an one direction.

**[0006]**

**[Means for Solving the Problem]** In order to attain this object, the gestalt of this invention The light emitting diode held at the leadframe, and the unit base holding said leadframe,

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**TECHNICAL FIELD**

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**PRIOR ART**

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[Description of the Prior Art] Generally, the light emitting diode (LED) used widely is formed with the semi-conductor until now so that it may be well-known, the light of the wavelength decided by minute size with an ingredient is emitted, and it has the property of operating by the low battery. Then, the outside used as a photo coupler combining photo detectors, such as a photo transistor, various electronic equipment is also used as a display component, and this LED is being used also as a light emitting device of optic fiber communication.

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**EFFECT OF THE INVENTION**

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[Effect of the invention] Light emitting diode which was held at the leadframe according to this invention as explained above, The unit base holding said leadframe, and the annular lens base material with which an end side is joined to said unit base, The reflective wall which is attached so that said light emitting diode may be surrounded in the center section of this lens base material, and reflects the outgoing radiation light from said light emitting diode. By having had the condenser lens arranged at the other end side of said lens base material so that the light transmission field surrounded by this reflective wall and said unit base may be taken up, and a lens fixed means to fix this condenser lens to said lens base material It becomes possible to raise the surrounding condensing nature of the optical axis which became possible [ setting up the luminous-intensity-distribution nature in connection with collection and distribution of light free, and creating to the application sense ], especially was stabilized, and moreover, assembly can be easy and can manufacture at a low price.

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**TECHNICAL PROBLEM**

[Problem(s) to be Solved by the Invention] In by the way, the case of the LED unit of the substrate mounting mold (surface mounting type) to this For example, after joining LED electrically on [ , such as a thing made from Hewlett Packard (United States), ] the leadframe formed in the package mold so that it might be easy to mount, Since a perimeter is really fabricated with a transperence epoxy resin etc. and he is trying to create a unit, Although it is a non-spread mold, since it is easy to carry out the diffused light of the light from LED to the perimeter section and luminous intensity thru/or brightness are not raised, when it is influenced of other light, such as daylight, and it is hard to view when used as a display device and it is included in an optical detector element, there is also fear of incorrect detection.

[0004] This invention has the 1st object in offering the suitable light emitting diode unit for the substrate mounting mold which can be set up free according to an application in the distance between a condenser lens and LED paying attention to the above-mentioned conventional problem.

[0005] Furthermore, the 2nd object of this invention has manufacture in offering the easy and suitable light emitting diode unit for the substrate mounting mold which can moreover collect light efficiently and can be made to output to an one direction.

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## MEANS

[Means for Solving the Problem] In order to attain this object, the gestalt of this invention The light emitting diode held at the leadframe, and the unit base holding said leadframe. The annular lens base material with which an end side is joined to said unit base, and the reflective wall which is attached so that said light emitting diode may be surrounded in the center section of this lens base material, and reflects the outgoing radiation light from said light emitting diode, It is characterized by having the condenser lens arranged at the other end side of said lens base material so that the light transmission field surrounded by this reflective wall and said unit base may be taken up, and a lens fixed means to fix this condenser lens to said lens base material.

[0007] According to this invention, in case the output light from light emitting diode penetrates a light transmission field, it is reflected by the reflective barrier surrounding a light transmission field, and while the part is mostly turned in the direction of a condenser lens, in response to the effect of the refractive index which a light transmission field has, incidence of it is carried out to a condenser lens. It is the thing which can be made to be able to carry out incidence to a condenser lens, without making stripping of the outgoing radiation light from light emitting diode carry out outside in this way in the converging form, and can be made to carry out outgoing radiation outside according to the property that a condenser lens has this light that carried out incidence. According to an application, it can set up outgoing radiation light, enabling free collection and distribution, and the effectiveness which raises the luminous intensity thru/or brightness by the formation of the parallel flux of light or focusing of outgoing radiation light is not only acquired, but can contribute to reduction of a production cost.

[0008]

[Embodiment of the Invention] Below, based on a drawing, the example of this invention is explained in detail and concretely.

[0009] First, it explains as an example by the 1st gestalt of this invention, referring to drawing 1 about the configuration of a light emitting diode (LED) unit with a ball lens. As shown in this drawing, as for the LED unit 1, the body consists of a ball lens 2, LED3, and its base material 4. That is, a base material 4 is really fabricated by heat-resistant resin, for example, polyamide system resin, thru/or the liquid crystal polymer including the leadframe 5 by the conductor for supplying bias voltage to LED3, and 6 is the reflective barrier with which mirror finish of the cone mold formed in the perimeter as enclosed LED3 was carried out. In addition, although plating processing by a metal membrane etc. may be performed in order to raise reflective effectiveness to a reflective barrier 6, at this example, it shall have a high reflection factor for the field of a reflective barrier 6 at the time of the shaping by using a white thing opaque as heat-resistant resin for base material 4 shaping.

[0010] Below, suppose the Johan part by which a reflective barrier 6 is formed in the circumference of LED3 of a base material 4 that reflector section (lens base material) 4A, a call, and a bottom half part are called the unit base. This perimeter side of the reflective barrier 6 which forms a cone mold mostly should just be set up so that the luminous-intensity-distribution property of a request of the transmitted light from the ball lens 2 may be acquired, while the shape of the shape of a truncated cone and paraboloid of revolution etc. makes the ball lens 2 turn and reflect many as outgoing radiation light from LED3 is made in short. In addition, although

the ball lens 2 was made easy to double with the spherical-surface configuration of the ball lens 2 the perimeter [ upper limb ] section of the reflective barrier 6 which receives the ball lens 2 of 4A of the reflector section in this example, and to receive it is not necessary to necessarily make the perimeter [ upper limb ] section into such a configuration, and as long as it is positioned so that the distance R to LED3 may serve as the predetermined set point from the core of the ball lens 2 in short, you may make it receive the ball lens 2, for example by said upper limb.

[0011] On the other hand, the ball lens 2 is formed so that the predetermined radius r may be acquired with heat-resistant light transmission resin, such as a glass or polyether aphone (product made from British ICI), or ATON (Japan Synthetic Rubber Co., Ltd. make). Furthermore, in drawing 1, 7 was the light transmission field of the LED3 upper part surrounded by the reflective barrier 6, and by this example, as specified quantity restoration of the heat-resistant epoxy resin of translucency was carried out to the light transmission field 7 in order to attach the ball lens 2 in a position, and air bubbles did not remain in the light transmission field 7, it joined the ball lens 2 to reflector section 4A. in addition — where the ball lens 2 is stabilized, as long as it is joined to reflector section 4A — also \*\*\*\*\* (ing) — as long as it is not necessary to fill up the light transmission field 7 with translucency resin, for example, an epoxy resin, and the light transmission field 7 is maintained so that light transmission may be possible, you may be a mere air space and it cannot be overemphasized that it may be filled up with matching oil etc.

[0012] With the LED component 1 with a lens which becomes the above configurations The refractive index nR which the ball lens 2 has while maintaining the distance R from LED3 to the ball center O of the ball lens 2 at size from the radius of the ball lens 2, and refractive index nC of the matter in the light transmission field 7 By combining appropriately, the above-mentioned distance R and the configuration of a reflective barrier 6 The flux of light from LED3 emitted in the air through the ball lens 2 can be mostly made into the parallel flux of light, it can be made to be able to condense, or the diffused light can be carried out, and it can consider as the LED component suitable for an application. In addition, although it can set up free as a configuration of a reflective barrier 6 as stated also in advance for example, as shown in drawing 2, when the configuration of a reflective barrier 6 is set to conical-surface-like 6A (left-hand side) or paraboloid-of-revolution-like 6B (right-hand side) The reflected light from LED3 is led to the ball lens 2 through these reflective barrier 6A or 6B, as an arrow head shows, the amount of [ which advances in accordance with the optical axis which connects LED3 and the ball center of the ball lens 2 ] Mitsunari increases, and the effectiveness which strengthens the output light from LED3 to the visual field from this direction is acquired.

[0013] Since the ball lens 2 can manufacture the description of this example as a sphere with high sphericity with design selection of the LED unit 1 with a lens being possible free [ collection and distribution ] as mentioned above, it is to have made positioning mounting of the ball lens 2 very easy in the creation process of the LED unit 1 with a lens. Namely, since the opening edge of a reflective barrier 6 positions the ball lens 2 by the free position in the case of anchoring, the optical axis can be held in the predetermined direction.

[0014] Then, the example by the 2nd gestalt of this invention is explained, referring to the following drawings.

[0015] Drawing 3 shows the configuration by the one example. Here, 12 is the plano-convex lens of the semi-sphere mold by this example. This plano-convex lens 12 is formed so that the predetermined radius r may be acquired with heat-resistant transparence resin, such as a glass thru/or polyether aphone or ATON, and the plano-convex lens 12 in this example is formed in the larger eye for how many minutes than a hemisphere. 12A is that flat side and incidence of the light from LED3 is carried out to a plano-convex lens 12 from this flat side 12A through the light transmission field 7. In addition, it is the lens positioning frame by which the periphery edge of that flat side 12A is joined to top-face 4B of reflector section 4A in the state of contact, and 8 is prepared in the object location of the perimeter [ top face ] section of reflector section 4A, or the four-corners section with the epoxy resin of translucency with which the light transmission field 7 is filled up with this plano-convex lens 12. As for the lens positioning frame 8, it is desirable to really be fabricated at the time of shaping by the resin of the base material 4

containing reflector section 4A, and the inside of the lens positioning frame 8 is fabricated according to the configuration of a lens 12.

[0016] Drawing 4 is other examples by the 2nd gestalt, and, in this example, it is not different from the above-mentioned example other than having formed the lens positioning frame 8 in the location for the four-corners section of reflector section top-face 4B. According to the example by the 2nd gestalt of this invention, it becomes possible to set up the distance R from the lens ball center O to LED3 regardless of the radius r of a plano-convex lens 12. In addition, it is not necessary to necessarily make this plano-convex lens 12 larger than a semi-sphere, and it is also more possible than a semi-sphere or a semi-sphere to consider as the lens of the thickness made into half-closed eyes, and the degree of freedom of the selection at the time of setting out can be increased as compared with the case of the 1st gestalt about the refractive index of the member enclosed with a plano-convex lens 12 and the light transmission field 7, the configuration of a reflective barrier 6, etc.

[0017] Drawing 5 shows the example of further others by the 2nd gestalt of this invention. The lens 22 twisted to this example constitutes flange 22B for carrying out positioning immobilization of lens section 22A and lens section 22A which function as a condenser lens at reflector section top-face 4B of a base material 4 with heat-resistant light transmission resin from a form made into one, as shown in drawing 5. 22C is the tooling holes which flange 22B drilled beforehand. By inserting in pin section 4C which protruded on such tooling-holes 22C from reflector section top-face 4B at the time of junction immobilization of a lens 12, a lens 22 is easily [ correctly and ] fixable to a base material 4. However, you may be a positioning means by fitting of hole 22C of this positioning, and pin section 4C.

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** It is the sectional view showing the example of a configuration by the 1st gestalt of this invention.

**[Drawing 2]** It is the explanatory view showing the example of an optical refraction path by the 1st gestalt of this invention by the cross section.

**[Drawing 3]** It is the sectional view showing the example of a configuration by the 2nd gestalt of this invention.

**[Drawing 4]** It is the perspective view separating and showing other examples of a configuration by the 2nd gestalt of this invention in a lens and a base material.

**[Drawing 5]** It is the explanatory view showing the example of a configuration of further others by the 2nd gestalt of this invention with a plan (A), a side elevation (B), and the A-A line sectional view (C) of (A).

**[Description of Notations]**

0 Ball Center

1 Light Emitting Diode (LED) Unit

2 Ball Lens

3 LED

4 Base Material

4A Reflector section

4B Top face

4C Pin section

5 Leadframe

6, 6A, 6B Reflective barrier

7 Light Transmission Field

8 Lens Positioning Frame

12 Plano-convex Lens of Semi-sphere Mold

12A Flat side (clamp face)

22 Shaping Lens

22A Lens section

22B Flange

22C Tooling holes

nR, nC Refractive index

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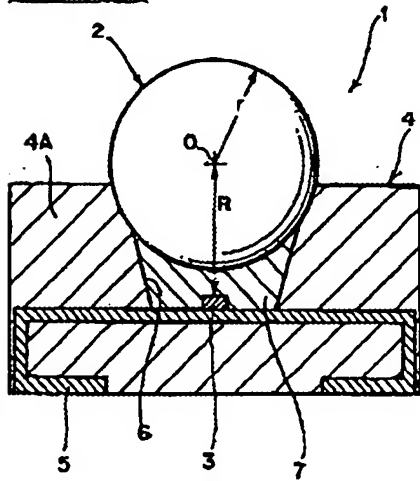
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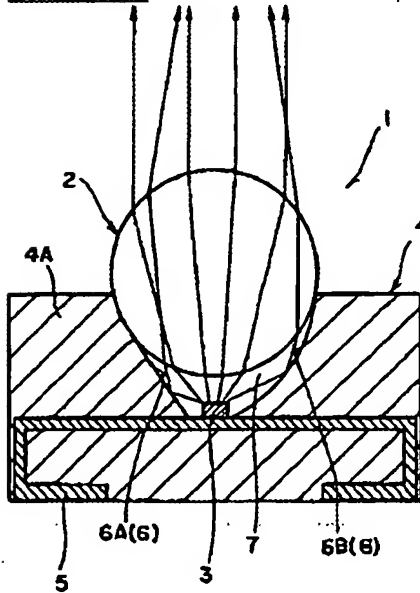
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## DRAWINGS

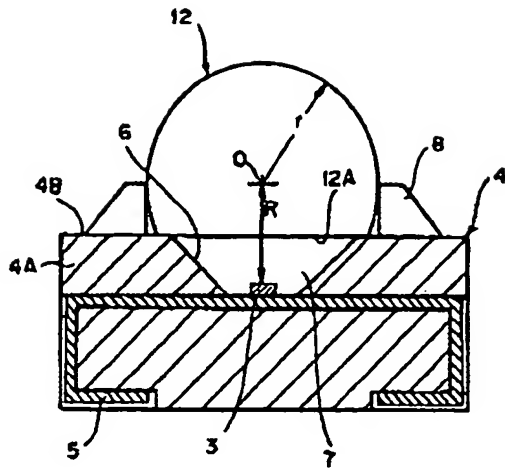
[Drawing 1]



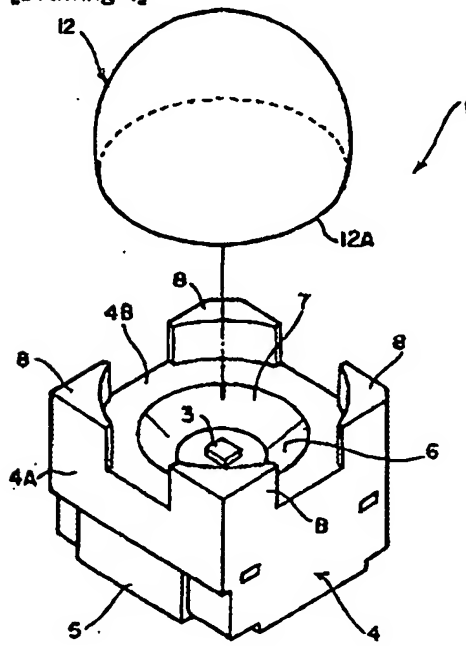
[Drawing 2]



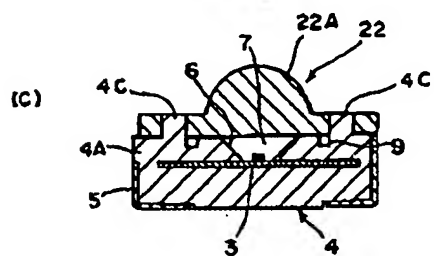
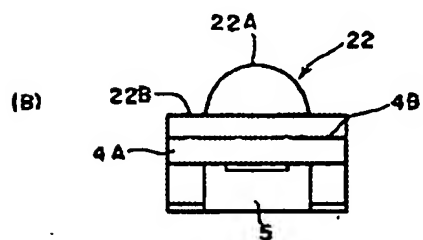
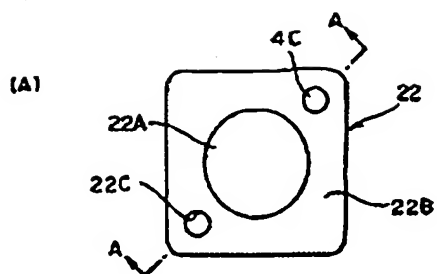
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]

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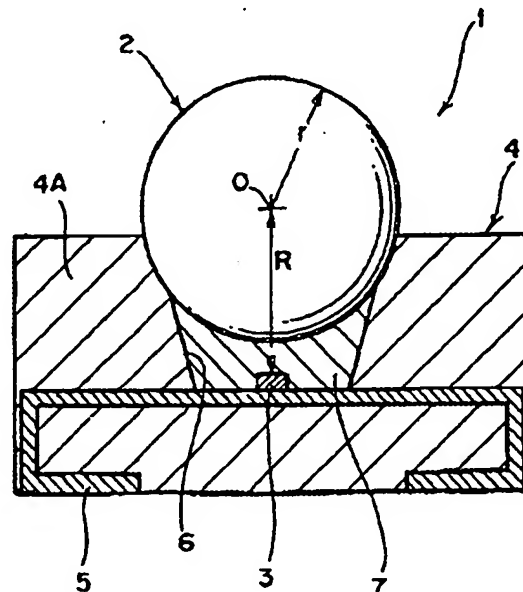
(74) 代理人 弁理士 谷 睦一 (外1名)

(54) 【発明の名称】 発光ダイオードユニット

(57) 【要約】

【課題】 レンズとLEDとの間の距離を用途に応じて自在に設定可能であり、かつ、LEDからの出力光を効率良く集約して一方向に出力させることのできる基板実装型に好適なLEDユニットを提供する。

【解決手段】 LED3とこれに印加電圧を供給するリードフレーム5と、LED3からの出射光を導くと共にその一部をほぼ同方向に導くための反射壁6により圍繞された透光領域7と、透光領域7のLED3直上に固定される集光レンズ2と、リードフレーム5を保持するユニットベース4と、反射壁6と一体成形され、集光レンズ2を支持するレンズ支持体4Aとを具備する。





## 【特許請求の範囲】

【請求項1】 リードフレームに保持された発光ダイオードと、

前記リードフレームを保持するユニットベースと、一端側が前記ユニットベースに接合される環状のレンズ支持体と、

該レンズ支持体の中央部に前記発光ダイオードを囲むように周設され前記発光ダイオードからの出射光を反射する反射壁部と、

該反射壁部と前記ユニットベースとによって囲まれた透光領域を塞ぐように前記レンズ支持体の他端側に配置される集光レンズと、

該集光レンズを前記レンズ支持体に固定するレンズ固定手段とを具えたことを特徴とする発光ダイオードユニット。

【請求項2】 前記リードフレームと前記ユニットベースと前記レンズ支持体とが一体成形されていることを特徴とする請求項1に記載の発光ダイオードユニット。

【請求項3】 前記レンズ固定手段は、前記透光領域に充填される透光性接着樹脂であることを特徴とする請求項1または2に記載の発光ダイオードユニット。

【請求項4】 前記レンズ支持体は、前記反射壁部の壁面を鏡面に仕上げた不透明白色樹脂にて形成されていることを特徴とする請求項1ないし3のいずれかの項に記載の発光ダイオードユニット。

【請求項5】 前記集光レンズは、球レンズであることを特徴とする請求項1ないし4のいずれかの項に記載の発光ダイオードユニット。

【請求項6】 前記集光レンズは、平凸レンズであることを特徴とする請求項1ないし4のいずれかの項に記載の発光ダイオードユニット。

【請求項7】 前記反射壁部は、前記集光レンズ側ほど大径となっていることを特徴とする請求項1ないし6のいずれかの項に記載の発光ダイオードユニット。

【請求項8】 前記レンズ支持体の他端面に前記集光レンズの位置決め手段をさらに具えたことを特徴とする請求項1ないし7のいずれかの項に記載の発光ダイオードユニット。

【請求項9】 前記平凸レンズの外周にフランジ部を形成したことを特徴とする請求項6に記載の発光ダイオードユニット。

【請求項10】 前記平凸レンズの凸面形状および屈折率と、前記発光ダイオードから前記平凸レンズの平坦面までの距離および前記透光領域の屈折率との組合せにより、前記平凸レンズからの出射光を集散自在に設定可能とすることを特徴とする請求項6ないし9のいずれかの項に記載の発光ダイオードユニット。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、発光ダイオードユ

ニットに関し、特に、基板面等への面実装に好適な高輝度の発光ダイオードユニットに関する。

## 【0002】

【従来の技術】 これまで一般に広く利用されている発光ダイオード(LED)は公知のように半導体によって形成されており、微小なサイズで材料によって決まる波長の可視光を放射し、かつ、低電圧で動作するなどの特性を有している。そこで、かかるLEDはフォトランシスタなどの受光素子と組合せてフォトカプラとして使用される外、各種電子機器等でもディスプレイ素子として用いられ、また、光ファイバ通信の発光素子としても利用されつつある。

## 【0003】

【発明が解決しようとする課題】 ところで、これ迄の基板実装型(サーフェスマウントタイプ)のLEDユニットの場合、例えばヒューレットパッカド社(アメリカ)製のものなど実装し易いようにパッケージ型に形成されたリードフレーム上にLEDを電気的に接合した上、周囲を透明エポキシ樹脂等で一体成形してユニットを作成するようにしているため、非点散型とはいうもののLEDからの光が周囲部に散光し易く、光度ないし輝度が高められないために日光など他の光の影響を受け、表示素子として使用される場合は目視しにくく、また、光学的検知素子に組込まれるような場合、誤検知の虞もある。

【0004】 本発明は、上記従来の問題に着目し、第1の目的は、集光レンズとLEDとの間の距離を用途に応じて自在に設定可能な基板実装型に好適な発光ダイオードユニットを提供することにある。

【0005】 更に本発明の第2の目的は、製造が容易でしかも光を効率良く集約して一方向に出力させることのできる基板実装型に好適な発光ダイオードユニットを提供することにある。

## 【0006】

【課題を解決するための手段】 かかる目的を達成するために、本発明の形態は、リードフレームに保持された発光ダイオードと、前記リードフレームを保持するユニットベースと、一端側が前記ユニットベースに接合される環状のレンズ支持体と、該レンズ支持体の中央部に前記発光ダイオードを囲むように周設され前記発光ダイオードからの出射光を反射する反射壁部と、該反射壁部と前記ユニットベースとによって囲まれた透光領域を塞ぐように前記レンズ支持体の他端側に配置される集光レンズと、該集光レンズを前記レンズ支持体に固定するレンズ固定手段とを具えたことを特徴とするものである。

【0007】 本発明によれば、発光ダイオードからの出力光が透光領域を透過する際、その一部は透光領域を囲む反射壁により反射されて、ほぼ集光レンズ方向に向けられると共に透光領域の有する屈折率の影響を受けて集光レンズに入射する。かくして発光ダイオードからの出

射光を集束する形で外部に放散させることなく集光レンズに入射させ、この入射した光を集光レンズの有する特性に応じて外部に出射させることができるもので、出射光の平行光東化あるいは集束によりその光度ないし輝度を高める効果が得られるのみならず、用途に応じて出射光を集散自在に設定することができ、生産コストの低減にも貢献できる。

【0008】

【発明の実施の形態】以下に、図面に基づいて本発明の実施例を詳細かつ具体的に説明する。

【0009】まず、本発明の第1の形態による実施例として、球レンズ付き発光ダイオード(LED)ユニットの構成について図1を参照しつつ説明する。この図に示すように、LEDユニット1は球レンズ2とLED3と、その支持体4とで主要部が構成される。すなわち、支持体4はLED3にバイアス電圧を供給するための導電体によるリードフレーム5を含め耐熱樹脂例えばポリアミド系樹脂ないし液晶ポリマーによって一体成形されるもので、6はLED3を取り囲むようにしてその周囲に設けられたコーン型の鏡面仕上げされた反射壁である。なお、反射壁6には反射効率を高めるために金属膜などによるメッキ処理が施されてもよいが、本実施例では支持体4成形用の耐熱樹脂として不透明白色のものをを用いることでその成形時に反射壁6の面を高い反射率を有するものとする事ができる。

【0010】以下では、支持体4のLED3周りに反射壁6が形成される上半部分をリフレクタ部(レンズ支持体)4Aと呼び、下半部分をユニットベースと呼ぶこととする。このほぼコーン型をなす反射壁6の周囲面は円錐台状ないし回転放物面状等、要はLED3からの出射光のできるだけ多くを球レンズ2に向けて反射させると共に球レンズ2からの透過光が所望の配光特性が得られるように設定されればよい。なお、本実施例ではリフレクタ部の4Aの球レンズ2を受ける反射壁6の上縁周囲部を球レンズ2の球面形状に合わせ、球レンズ2を受け易くしたが、必ずしも上縁周囲部をそのような形状としなくともよく、要は球レンズ2の中心からLED3までの距離Rが所定の設定値となるように位置決めされる限り、例えば前記上縁で球レンズ2を受けるようにしてもよい。

【0011】一方、球レンズ2はガラスないしはポリエーテルサルフォン(英国ICI社製)あるいはアトーン(日本合成ゴム社製)等の耐熱性透光樹脂により所定の半径rが得られるように形成される。更に図1において、7は反射壁6によって囲繞されるLED3上部の透光領域であり、本実施例では球レンズ2を所定の位置に取付けるべく透光領域7に透光性の耐熱エポキシ樹脂を所定量充填し、透光領域7に気泡が残らないようにして球レンズ2をリフレクタ部4Aに接合した。なお、球レンズ2が安定した状態でリフレクタ部4Aに接合される

限り、必ずしも透光領域7に透光性樹脂、例えばエポキシ樹脂を充填する必要はなく、透光領域7が透光可能なように保たれる限り、単なる空気層であってもよいし、マッティングオイルなどを充填してもよいことはいまでもない。

【0012】以上のような構成になるレンズ付きLED素子1では、LED3から球レンズ2の球心Oまでの距離Rを球レンズ2の半径より大に保つと共に球レンズ2の有する屈折率 $n_1$ 、透光領域7内の物質の屈折率 $n_2$ と上記の距離Rおよび反射壁6の形状を適切に組合せることで、球レンズ2を介して空中に放射されるLED3からの光束をほぼ平行光束にしたり、あるいは集光させたり散光させることができ、用途に適したLED素子とすることができる。なお、反射壁6の形状としては、先にも述べたように自在に設定可能であるが、例えば、反射壁6の形状を図2に示すように円錐面状6A(左側)あるいは回転放物面状6B(右側)とした時には、これらの反射壁6Aあるいは6Bを介してLED3からの反射光を球レンズ2に導き、矢印で示すようにLED3と球レンズ2の球心とを結ぶ光軸に沿って進行する光成分が多くなり、この方向からの視野に対してLED3からの出力光を強める効果が得られる。

【0013】本実施例の特徴は、上述したように集散自在にレンズ付きLEDユニット1の設計選択が可能であることと共に球レンズ2が真球度の高い球体として製造可能であることから、レンズ付きLEDユニット1の作成工程において球レンズ2の位置決め取付を極めて容易としたことにある。すなわち、取付けの際、球レンズ2を自在な姿勢により反射壁6の開口端によって位置決めされるため、その光軸を所定の方向に保持することができる。

【0014】続いて、本発明の第2の形態による実施例を以下の図を参照しつつ説明する。

【0015】図3はその一実施例による構成を示す。ここで、12は本実施例による半球型の平凸レンズである。この平凸レンズ12は例えばガラスないしポリエーテルサルフォンあるいはアトーン等の耐熱性透明樹脂により所定の半径rが得られるように形成されるもので、本例の場合の平凸レンズ12は半球体より幾分大きい目に形成されている。12Aはその平坦面であり、LED3からの光は透光領域7を介してこの平坦面12Aから平凸レンズ12に入射する。なお、この平凸レンズ12は例えば透光領域7に充填される透光性のエポキシ樹脂によりその平坦面12Aの外周縁部がリフレクタ部4Aの上面4Bに当接状態で接合されるもので、8はリフレクタ部4Aの上面周囲部あるいは四隅部の対象位置に設けられているレンズ位置決め枠である。レンズ位置決め枠8はリフレクタ部4Aを含む支持体4の樹脂による成形時に一体成形されることが望ましく、レンズ位置決め枠8の内側はレンズ12の形状に合わせて成形される。

【0016】図4は第2の形態による他の実施例で、本例の場合はレンズ位置決め枠8をリフレクタ部上面4Bの四隅部対称位置に設けたこと以外は上記の実施例と変わらない。本発明の第2の形態による実施例によれば、レンズ球心0からLED3迄の距離Rを平凸レンズ12の半径rに関係なく設定することが可能となる。なお、この平凸レンズ12を必ずしも半球より大きくする必要はなく、半球若しくは半球より薄目とした厚さのレンズとすることも可能であり、平凸レンズ12および透光領域7に封入される部材の屈折率、反射壁6の形状等につ

いて設定時の選択の自由度を第1の形態の場合に比して増すことができる。

【0017】図5は本発明の第2の形態による更に他の実施例を示す。本例によるレンズ22は図5に示すように、集光レンズとして機能するレンズ部22Aとレンズ部22Aを支持体4のリフレクタ部上面4Bに位置決め固定するためのフランジ部22Bとを一体とした形で耐熱性透光樹脂により構成する。22Cはフランジ部22Bの予め穿設した位置決め孔である。このような位置決め孔22Cにリフレクタ部上面4Bから突設したピン部4Cをレンズ12の接合固定時に嵌め合わせること、正確かつ、容易にレンズ22を支持体4に固定することができる。但し、かかる位置決め孔22Cとピン部4Cとの嵌合によらない位置決め手段であってもよい。なお、図5の(C)に示す9はレンズ22の固定時に透光領域7から溢出する接着樹脂を逃すための逃し溝であり、逃し溝9に溢出した樹脂の固化によりレンズ22のレンズ台部22Bを一層強固確実に支持体4上に接合させることが可能となる。

【0018】本実施例によれば、微小なレンズ22の形状を成型金型により統一した同一形状にすることができ、しかもそのレンズ部22Aの形状を集光、散光に応じて自在に設定することが可能となる。

【0019】なお、以上に述べた実施例ではレンズを主として集光のために設けるものとして説明してきたが、LED素子の使用状態に応じて散光角度を限定するなど光束に限られた範囲での方向性を持たせるように、レンズの種類とLEDとの間の相対位置および反射壁面の形状を自在に設定することができるという各形態に共通の利点が得られるものである。

【0020】

【発明の効果】以上説明してきたように、本発明によれば、リードフレームに保持された発光ダイオードと、前記リードフレームを保持するユニットベースと、一端側

が前記ユニットベースに接合される環状のレンズ支持体と、該レンズ支持体の中央部に前記発光ダイオードを囲むように周設され前記発光ダイオードからの出射光を反射する反射壁部と、該反射壁部と前記ユニットベースとによって囲まれた透光領域を塞ぐように前記レンズ支持体の他端側に配置される集光レンズと、該集光レンズを前記レンズ支持体に固定するレンズ固定手段とを具備したことで、光の集散にかかわる配光性を自在に設定して用途向きに作成することが可能となり、特に安定した光軸のまわりの集光性を高めることが可能となり、しかも組立が容易で廉価に製造することができる。

【図面の簡単な説明】

【図1】本発明の第1の形態による構成例を示す断面図である。

【図2】本発明の第1の形態による光の屈折経路例を断面によって示す説明図である。

【図3】本発明の第2の形態による構成例を示す断面図である。

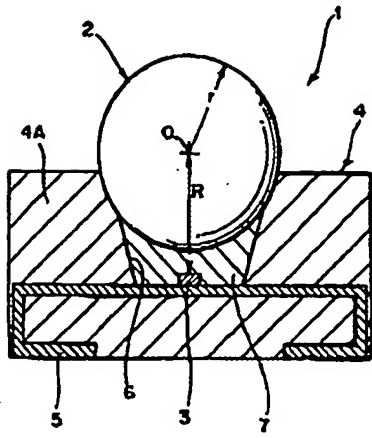
【図4】本発明の第2の形態による他の構成例をレンズと支持体とに分離して示す斜視図である。

【図5】本発明の第2の形態による更に他の構成例を上面図(A)、側面図(B)および(A)のA-A線断面図(C)によって示す説明図である。

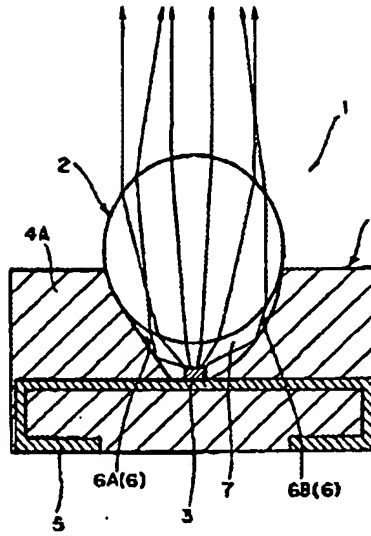
【符号の説明】

- 0 球心
- 1 発光ダイオード(LED)ユニット
- 2 球レンズ
- 3 LED
- 4 支持体
- 4A リフレクタ部
- 4B 上面
- 4C ピン部
- 5 リードフレーム
- 6, 6A, 8B 反射壁
- 7 透光領域
- 8 レンズ位置決め枠
- 12 半球型の平凸レンズ
- 12A 平坦面(取付面)
- 22 (成形)レンズ
- 22A レンズ部
- 22B フランジ部
- 22C 位置決め孔
- n<sub>a</sub>, n<sub>c</sub> 屈折率

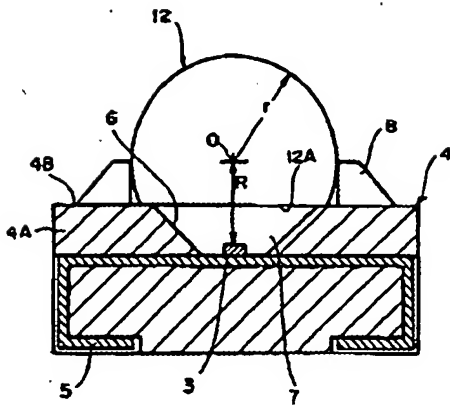
【図1】



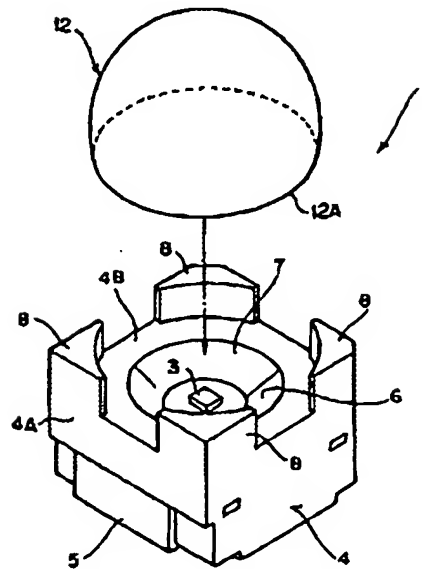
【図2】



【図3】



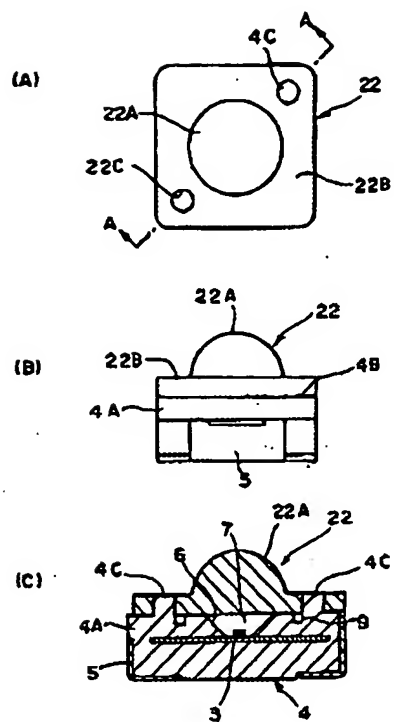
【図4】



(5)

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【図5】



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